

Rust Never Sleeps, But Metal Guard® Can Prevent Corrosion

Often, the shortest distance between manufactured parts and the surface finishing they need is a straight line that can take a few feet or many miles, sometimes days or weeks. In the meantime, rust and other oxidation can start forming on those parts, which can drive up costs through additional cleaning and surface preparation.

It's a problem faced by both sides of the manufacturing process: those who make the parts and ship them to be finished to specification and the finishers who often get parts with some rust or foreign matter on them because of the time delay.

Research has shown that iron can begin to corrode within minutes when it becomes wet. The bright, orange corrosion is often called "flash rust" or "rapid corrosion". It is mainly comprised of lepidocrocite, which is an iron oxide hydroxide [$\gamma\text{-Fe}^{3+}\text{O}(\text{OH})$] that is also referred to as iron (III) hydroxide oxide or iron (III) oxyhydroxide when iron is alloyed with other elements — such as steel, cast iron, stainless steel, and others — the same corrosion can take place.

Combatting Rapid Corrosion

The cause of the rapid corrosion is relatively straightforward: parts made with iron as an alloy react with water and become oxidized, meaning they lose electrons ($\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$). Dissolved oxygen gas is also reduced, which gains electrons ($\text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^- \rightarrow 4\text{OH}^-$). The two reactions occur simultaneously, but they may not always happen at the same place on the part. As the part surface begins to dry, the water layer becomes thinner, which causes the surface corrosion to accelerate.

Even if the part does not get wet, it can still generate some corrosion at locations with high relative humidity (RH). Research has shown that parts exposed to RH corrode more slowly and that the surface of the material is probably covered in absorbed water that may make it appear dry; anything above 65% RH means that an iron part will corrode in the same way as if it were covered in water.

In addition, dirt particles and other impurities—including salts from fingerprints and acidic pollutants—can also trigger rapid corrosion in low RH environments because they can trap moisture on the metal surface.

Because parts often sit in warehouses and loading docks before they are given a surface treatment at a captive operation or sent offsite to a finishing shop, rapid corrosion can become a significant issue if manufacturers do not apply an inhibitor while the part is waiting for proper disposition.

News Ways to Prevent Rust

Hubbard-Hall, a company helping manufacturers with their surface finishing challenges for ferrous and non-ferrous metals since 1849, has full-time laboratory personnel who have been studying and researching the causes and solutions for rapid corrosion matters for several decades.

The company now offers over 40 rust-preventative solutions in its Metal Guard® line of products, with variations based on the part surface type, the duration of exposure, and the required exposure and film characteristics. The Metal Guard® line includes solvent, oil, solvent/oil, acrylic/wax emulsions, and water-based (aqueous) solutions.

Larry Ensley, Hubbard-Hall's technical service manager who has worked in the chemical industry for almost 30 years, says the Metal Guard® products are primarily used on steel and function as a barrier coating to prevent rust and corrosion. They can also be used as a topcoat over other coatings or on bare substrates.

"There are solutions to prevent rapid corrosion in short- to medium-term indoor production, and for more extensive periods, too," Ensley says. "The Metal Guard® inhibitors are meeting and exceeding numerous ASTM standards and are truly proving effective in safe manufacturers and finishers time and money in these processes."

Improving from 3 – 15 Days of Prevention

Hubbard-Hall has introduced three new products to the Metal Guard® line, and each has worked remarkably in the field to help reduce corrosion and costs.

Metal Guard® 700 is an emulsion rust preventative that offers outstanding corrosion protection to blackened, phosphate, and bare metal surfaces during storage and transportation. After water evaporation, the product emulsion leaves a fragile dry film.

"We've had customers get 15 days of protection from Metal Guard® 700, which is about 12 days more than before when using a competitor's product," Ensley says. "It gives 360 hours of ASTM D-2247 over bare steel and is excellent on nickel with 1,704 hours ASTM D-2247 over Ni-clad battery cans."

Since it is a water emulsion, parts can be processed through it without pre-drying. Ensley says Metal Guard® 700 coating will air-dry in a relatively short time, and that period can be shortened by force drying with warm air or in heated spin dryers no higher than 150°F. If it becomes necessary to reprocess the parts, the coating may be removed in a hot alkaline cleaner or vapor degreaser."

Doubling Corrosion Protection Time

Hubbard-Hall also developed Metal Guard® 560 to be the final finish on an engineered black oxide coating where 150 to 200 hours of salt spray resistance is needed but dimensional change cannot be tolerated. The solvent-based, water-displacing rust preventative can be applied by dipping, spraying, or brushing and will displace moisture on the metal surface to leave a continuous film of Metal Guard® 560 in direct contact with the metal surface.

"We've had a lot of success with the 560 products in rust and corrosion protection, and our customers are telling us they are getting twice the corrosion protection of competing products they were using," says Ensley, who added that the product is working very well on various parts and a myriad of industries, especially steel castings.

Metal Guard® 560, which meets Mil-C-16173 Grade 3 specifications, has been shown to improve corrosion protection, safety and the working environment while also reducing energy cost. It has rapid water displacement, a high flashpoint for safety, and can be used at ambient temperature with low odor.

"We are working with an automotive manufacturer who is using Metal Guard® 560 over steel castings and seeing greater than four years of shelf life on their parts," Ensley says. "The added benefit is it is less viscous than competing products, so there is less drag out and becomes more economical because of less usage."

Economical and Versatile Rust Preventor

Metal Guard® 320 has also been introduced to the market as an economical and versatile rust-preventative soluble oil that, when mixed with water and heated to 140°F to 150°F, leaves a corrosion-resistant, semi-dry film.



“It is typically applied to metal surfaces by immersion, but it can be brushed or sprayed at low pressure (30-40 psi) and at low temps to reduce foaming,” Ensley says. “It is an excellent rust preventive recommended for ‘dry-to-touch’ finish requirements on phosphate surfaces specified for military and automotive applications.”

A 10% solution of Metal Guard® 320 will provide 250 – 300 hours of ASTM B-117 salt spray protection over a heavy zinc phosphate coating; it is recommended for use on black oxide and bare steel surfaces.

“It has a long production life, and the concentration can be maintained by adding more Metal Guard® 320 and water,” he says. “We’re seeing a 25% improvement in corrosion protection for some customers who have switched to this compared to when they were using another company’s product, so it has had some great results in the field.”

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**For more information on this process,
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